Monthly Noise Monitoring Assessment

Tomingley Gold Mine, May 2017

Prepared for : Tomingley Gold Operations Pty Limited

May 2017

MAC
Muller Acoustic Consulting

Document Information

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Document ID	Status	Date	Prepared	Signed
MAC160270RP11	Final	30 May 2017	Oliver Muller (MAAS)	

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Tomingley Gold Operations Pty Ltd (TGO) to complete a Noise Monitoring Assessment (NMA) for Tomingley Gold Mine ('the mine').

The NMA involved quantifying the noise contribution of the mine by direct attended measurements to determine mining noise emissions so that effective management and controls can be implemented to minimise noise levels within the surrounding community. The monitoring has been conducted in accordance with the TGO Noise Management Plan and in general accordance with Conditions L4.2 to L4.7 of the EPL at six representative receiver locations. It is noted that this assessment has not been completed as part of the annual noise monitoring program to address conditions of the Environmental Protection License (EPL).

The assessment has been conducted in accordance with the following documents:

- NSW Environment Protection Authority (EPA), Industrial Noise Policy (INP), 2000;
- Environment Protection Licence EPL 20169 (EPL); and
- Standards Australia AS 1055.1:1997 - Acoustics - Description and measurement of environmental noise - General Procedures.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

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2 Environmental Protection License Noise Limits

Historic assessments for the mine categorise receivers into Noise Assessment Groups (NAGs). The NAGs were derived based on ambient noise data that controlled receiver RBLs.

Table 1 reproduces the operational and sleep disturbance noise limits for assessed receivers referenced from the EPL that have been adopted for this NMA and are consistent with historic EPL monitoring locations.

Table 1 Noise Limits, dBA

Noise Assessment Group	Receivers	Day	Evening	Night	
		LAeq(15-min)	LAeq(15-min)	LAeq(15-min)	LA1(1-min)
NAG A	R1, R6	36	36	36	45
	R5	37	37	37	45
	R4	36	36	36	45
NAG B	R2	36	36	36	45
NAG C	R3	49	40	40	45
	R29	48	40	40	45
NAG D	R23	43	39	39	46

Note: Refer to figure in Appendix 4 of Project Approval 09-0155 for noise locations. However, these criteria do not apply if the Proponent has an agreement with the relevant owner(s) of these residences / land to generate higher noise levels, and the Proponent has advised the Department of Planning and Infrastructure and EPA in writing of the terms of this agreement.

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3 Methodology

3.1 Locality

TGO is located to the south of the village of Tomingley, NSW. Receivers in the locality surrounding the mine are primarily rural/residential and for consistency the naming conventions for each receiver has been retained from historic noise assessments. The monitoring locations with respect to the mine is presented in the locality plan shown in **Figure 1.**

3.2 Assessment Methodology

The attended noise survey was conducted in general accordance with the procedures described in Australian Standard AS 1055-1997, "Acoustics - Description and Measurement of Environmental Noise" and the EPL. The measurements were carried out using Svantek Type 1, 971 noise analyser from Tuesday 2 May 2017 to Thursday 4 May 2017. The acoustic instrumentation used carries current NATA calibration and complies with AS IEC 61672.1-2004-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

Both evening and night measurements were of 15 minutes in duration. Where possible, throughout each survey the operator quantified the contribution of each significant noise source. Extraneous noise sources were excluded from the analysis as to calculate the $L_{Aeq(15\text{-}min)}$ mine noise contribution for comparison against the relevant EPL limit.

Prevailing meteorological conditions for the monitoring period were sourced from TGO's meteorological station and analysed in accordance with Appendix E4 of the INP to determine the stability category present at the time of each measured sample. This was undertaken to determine applicability of results in accordance with Condition L4.3 of the EPL. Results obtained during non-prevailing meteorological conditions (ie F Class Stability in conjunction with a 2m/s drainage wind or a G Class Stability) are considered not applicable against the EPL criteria.

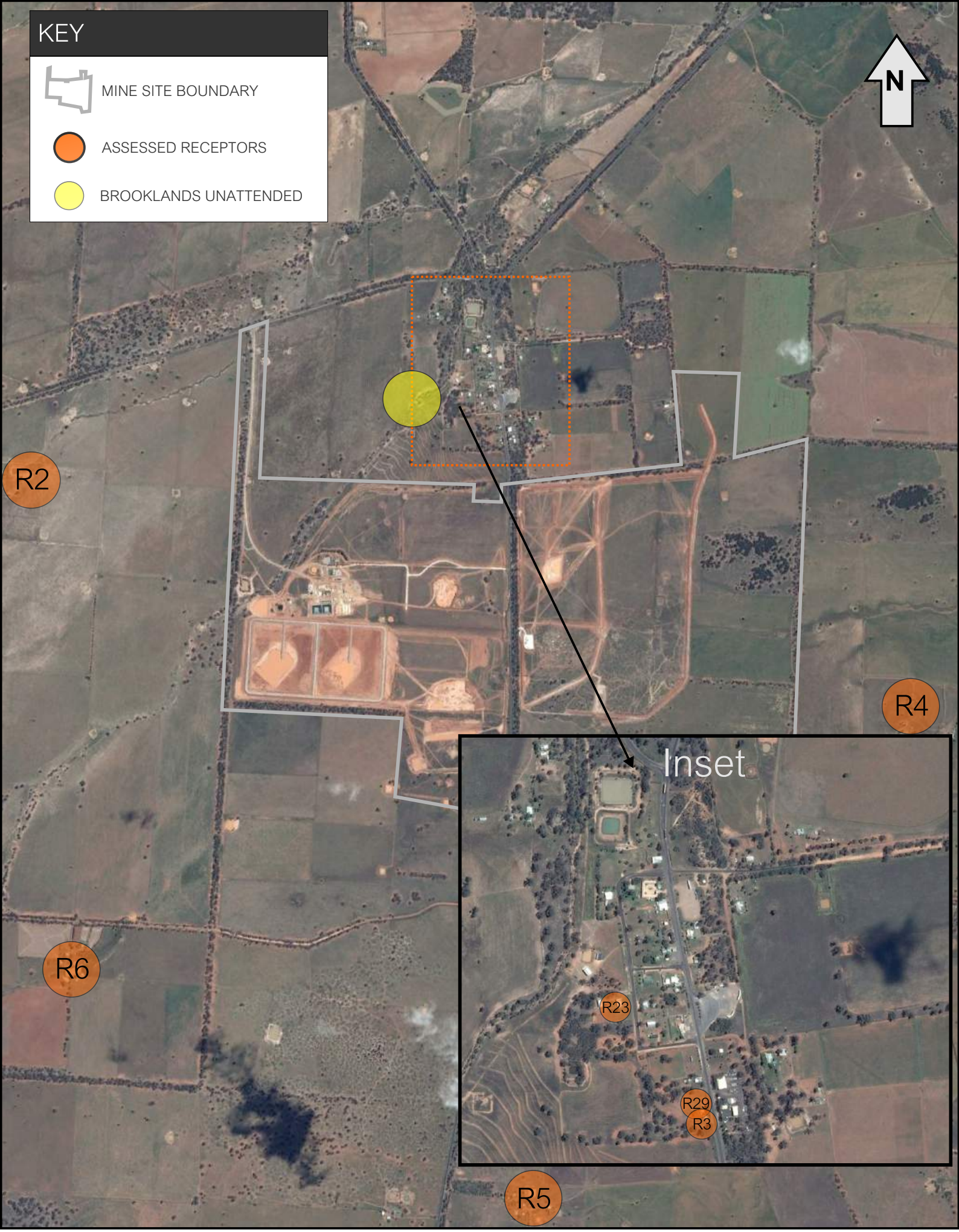

FIGURE 1 - LOCALITY PLAN AND ASSESSMENT LOCATIONS

TOMINGLEY GOLD MINE EPL NOISE MONITORING

REF: MAC160270

0 1000m

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4 Results

The monitoring and assessment results are presented in individual tables for each assessment location.

4.1 Assessment Results - Location R2

The results of the attended noise measurements at location R2 for Tuesday 2 May 2017 to Thursday 4 May 2017 are summarised in **Table 2** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the mining noise contribution.

Table 2 Operator-Attended Noise Survey Results – Location R2

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		LAmax	LA_{eq}	LA_{90}			
02/05/17	21:44	53	39	38	36	Dir: SW 2 m/s Stab Class: D	Wind in trees <35 Highway traffic 35-38 Mine hum 33-35 Dog 47
TGO Site LAeq(15-min) Contribution							35
02/05/17	22:00	53	39	37	36	Dir: S 2 m/s Stab Class: D	Highway traffic 38-40 Mine hum 33-35 Livestock 36
TGO Site LAeq(15-min) Contribution							35
03/05/17	21:41	68	49	42	36	Dir: NE 5 m/s Stab Class: D	Wind in trees 44-53 Highway traffic <44 Mine hum <36
TGO Site LAeq(15-min) Contribution							<36
03/05/17	22:01	64	46	40	36	Dir: NE 6 m/s Stab Class: D	Wind in trees 36-43 Highway traffic <36 Mine hum <36
TGO Site LAeq(15-min) Contribution							<36
04/05/17	21:16	64	48	40	36	Dir: NE 5 m/s Stab Class: D	Highway traffic <36 Wind in trees 39-62 Mine hum <33
TGO Site LAeq(15-min) Contribution							<33
04/05/17	22:00	64	50	42	36	Dir: NE 5 m/s Stab Class: D	Wind in trees 44-56 Mine hum 33-36 Highway traffic 36-44
TGO Site LAeq(15-min) Contribution							35

Note 1: Meteorological data obtained from TGO's on-site weather station.

4.2 Assessment Results - Location R3/R29

The results of the attended noise measurements at location R3/R29 for Tuesday 2 May 2017 to Thursday 4 May 2017 are summarised in **Table 3** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the mining noise contribution. It is noted that both locations R3 and R29 are within 10m of each other and therefore have been assessed simultaneously.

Table 3 Operator-Attended Noise Survey Results – Location R3/R29

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		LAmax	LAeq	LA90			
02/05/17	20:56	87	66	46	40	Dir: S 5 m/s Stab Class: D	Highway traffic 45-83 Mine hum 35 Wind in trees <45
		TGO Site LAeq(15-min) Contribution					35
02/05/17	22:44	86	66	43	40	Dir: S 3 m/s Stab Class: D	Mine hum 40 Insects <40 Highway traffic 40-80
		TGO Site LAeq(15-min) Contribution					40
03/05/17	20:51	87	66	38	40	Dir: N 5 m/s Stab Class: D	Wind in trees 33-43 Highway traffic 35-80 Idle truck <35
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
03/05/17	22:40	83	64	43	40	Dir: NE 5 m/s Stab Class: D	Idle truck 45-47 Highway traffic 45-82 Wind in trees <45
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
04/05/17	20:35	86	66	38	40	Dir: N 4 m/s Stab Class: D	Highway traffic 34-81 Wind in trees <34 Idle truck 34-35
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
04/05/17	22:40	84	63	43	40	Dir: NE 5 m/s Stab Class: D	Idle truck 42-47 Wind in trees <42 Highway traffic 42-83
		TGO Site LAeq(15-min) Contribution					TGO Inaudible

Note 1: Meteorological data obtained from TGO's on-site weather station.

4.3 Assessment Results - Location R4

The results of the attended noise measurements at location R4 for Tuesday 2 May 2017 to Thursday 4 May 2017 are summarised in **Table 4** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the mining noise contribution.

Table 4 Operator-Attended Noise Survey Results – Location R4

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		LAmax	LAeq	LA90			
02/05/17	19:57	58	37	36	36	Dir: S 3 m/s Stab Class: E	Wind in trees <36 Highway traffic 35-37 Mine hum 33-36
		TGO Site LAeq(15-min) Contribution					34
02/05/17	23:34	56	37	35	36	Dir: S 2 m/s Stab Class: D	Highway traffic 34-36 Mine hum 35 Wind in trees 36
		TGO Site LAeq(15-min) Contribution					35
03/05/17	19:59	61	46	38	36	Dir: N 4 m/s Stab Class: F	Wind in trees 34-58 Highway traffic <34
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
03/05/17	23:27	68	52	46	36	Dir: E 9 m/s Stab Class: D	Wind in trees 38-56
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
04/05/17	19:47	61	45	41	36	Dir: NE 7 m/s Stab Class: E	Wind in trees 44-56
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
04/05/17	23:25	67	49	43	36	Dir: E 9 m/s Stab Class: D	Wind in trees 44-50
		TGO Site LAeq(15-min) Contribution					TGO Inaudible

Note 1: Meteorological data obtained from TGO's on-site weather station.

4.4 Assessment Results - Location R5

The results of the attended noise measurements at location R5 for Tuesday 2 May 2017 to Thursday 4 May 2017 are summarised in **Table 5** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the mining noise contribution.

Table 5 Operator-Attended Noise Survey Results – Location R5

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		LAmax	LAeq	LA90			
02/05/17	19:28	85	64	31	37	Dir: S 2 m/s Stab Class: D	Wind in trees 28-32 Highway traffic 32-83 Wind in trees 35
TGO Site LAeq(15-min) Contribution							TGO Inaudible
02/05/17	23:57	84	64	39	37	Dir: S 2 m/s Stab Class: D	Wind in trees <36 Insects <36 Highway traffic 36-83
TGO Site LAeq(15-min) Contribution							TGO Inaudible
03/05/17	19:35	80	62	23	37	Dir: N 2 m/s Stab Class: F	Highway traffic 24-80 Wind in trees <24 Insects <24
TGO Site LAeq(15-min) Contribution							TGO Inaudible
03/05/17	23:51	81	59	42	37	Dir: ENE 7 m/s Stab Class: D	Wind in trees 38-46 Highway traffic 46-78 Insects <46
TGO Site LAeq(15-min) Contribution							TGO Inaudible
04/05/17	19:24	80	61	35	37	Dir: NE 4 m/s Stab Class: D	Highway traffic 38-78 Wind in trees 34-38 Insects <34
TGO Site LAeq(15-min) Contribution							TGO Inaudible
04/05/17	23:46	79	57	42	37	Dir: NE 4 m/s Stab Class: D	Highway traffic 40-76 Wind in trees 34-40
TGO Site LAeq(15-min) Contribution							TGO Inaudible

Note 1: Meteorological data obtained from TGO's on-site weather station.

4.5 Assessment Results - Location R6

The results of the attended noise measurements at location R6 for Tuesday 2 May 2017 to Thursday 4 May 2017 are summarised in **Table 6** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the mining noise contribution.

Table 6 Operator-Attended Noise Survey Results – Location R6

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			EPL Limit	Meteorology[1]	Description and SPL, dBA
		LAmax	LAeq	LA90			
02/05/17	20:27	59	37	34	36	Dir: S 3 m/s Stab Class: D	Wind in trees 28-33 Highway traffic 33-39
		TGO Site LAeq(15-min) Contribution					TGP Inaudible
02/05/17	23:06	64	38	35	36	Dir: S 2 m/s Stab Class: D	Insects <38 Highway traffic 36-38 Mine hum 33-35
		TGO Site LAeq(15-min) Contribution					33
03/05/17	20:28	64	40	37	36	Dir: NE 4 m/s Stab Class: F	Livestock <36 Highway traffic 36-42 Crushing plant 31-34 Wind in trees <36
		TGO Site LAeq(15-min) Contribution					34
03/05/17	23:02	61	44	40	36	Dir: NE 6 m/s Stab Class: D	Wind in trees <40 Mine hum 33-36 Highway traffic 33-41
		TGO Site LAeq(15-min) Contribution					35
04/05/17	20:13	62	46	42	36	Dir: NE 5 m/s Stab Class: E	Insects Wind in trees 40-46 Highway traffic <40 Mine hum<36
		TGO Site LAeq(15-min) Contribution					<36
04/05/17	23:00	70	49	44	36	Dir: NE 7 m/s Stab Class: D	Wind in trees 43-45 Mine hum <36 Highway traffic 38-43
		TGO Site LAeq(15-min) Contribution					<36

Note 1: Meteorological data obtained from TGO's on-site weather station.

4.6 Assessment Results - Location R23

The results of the attended noise measurements at location R23 for Tuesday 2 May 2017 to Thursday 4 May 2017 are summarised in **Table 7** along with prevailing meteorological conditions at the time of each survey, relevant EPL limits and the mining noise contribution.

Table 7 Operator-Attended Noise Survey Results – Location R23

Date	Time (hrs)	Descriptor (dBA re 20 µPa) LAmax	LAeq	LA90	EPL Limit	Meteorology[1]	Description and SPL, dBA
02/05/17	21:16	57	48	44	39	Dir: SW 4 m/s Stab Class: D	Local residential noise 40-46 Mine hum 36-39 Highway traffic 42-44
		TGO Site LAeq(15-min) Contribution					39
02/05/17	22:25	60	45	41	39	Dir: S 2 m/s Stab Class: D	Mine hum 36-39 Wind in trees <39 Highway traffic 40-42
		TGO Site LAeq(15-min) Contribution					39
03/05/17	21:13	56	46	38	39	Dir: N 4 m/s Stab Class: D	Birds Highway traffic 46-56 Wind in trees <46
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
03/05/17	22:22	60	47	43	39	Dir: N 5 m/s Stab Class: D	Idle trucks 43-46 Wind in trees <43 Highway traffic 43-56
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
04/05/17	20:53	59	46	39	39	Dir: N 5 m/s Stab Class: D	Highway traffic 38-54 Wind in trees 38-43
		TGO Site LAeq(15-min) Contribution					TGO Inaudible
04/05/17	22:23	56	45	42	39	Dir: N 4 m/s Stab Class: D	Highway traffic 46-53 Idle trucks 46-48 Wind
		TGO Site LAeq(15-min) Contribution					TGO Inaudible

Note 1: Meteorological data obtained from TGO's on-site weather station.

5 Discussion

5.1 Discussion of Results - Location R2

Monitoring between Tuesday 2 May 2017 to Thursday 4 May 2017 identified that TGO noise was audible on all six occasions. Noise contribution from TGO when audible was measured at between 33dBA and <36dBA, and therefore satisfied the relevant noise limits of 36dBA.

5.2 Discussion of Results - Location R3/R29

Monitoring results for R3/R29 were dominated by highway traffic that was constant during all measurements. TGO emissions were audible on two of six occasions and was masked by highway traffic. Mining noise contributions ranged between 35dBA and 40dBA, therefore satisfied the relevant noise limit of 40dBA. Extraneous sources other than highway traffic were also audible during the survey such as insects, wind and idling trucks.

5.3 Discussion of Results - Location R4

Mine noise was audible on two of six occasions during the May 2017 survey period with contributions of 32dBA and 33dBA and satisfied the EPL criteria. Non-mining noise sources included wind in trees and highway traffic.

5.4 Discussion of Results - Location R5

Mining noise emissions were inaudible during all six attended noise monitoring surveys at this location for the May 2017 monitoring assessment. The relevant noise limits of 37dBA were satisfied as TGO emissions remained inaudible. Highway traffic was the dominant source at this receiver with non-mining sources including insects and wind in trees audible.

5.5 Discussion of Results - Location R6

TGO mine hum was audible on five of six occasions throughout the May 2017 monitoring period at R6. The $LA_{eq(15\text{-}min)}$ mine noise contribution ranged between 33dBA and <36dBA and satisfied the relevant EPL noise limit of 36dBA $LA_{eq(15\text{-}min)}$. Non-mining sources included Insects, highway traffic and wind in trees.

5.6 Discussion of Results - Location R23

Mining noise was audible on two of six occasions at this location. TGO was audible during measurements on the two periods of 2 May 2017 with TGO emissions being <39dBA for both measurements, and remained below the relevant EPL criteria of 39dBA. Non-mining sources included highway traffic, insects, idling trucks, local residential noise, wind in trees and birds.

6 Comparison of Attended and Unattended Monitoring Results

To address Condition 6 of Schedule 3 of the Project Approval, a program to calibrate and validate the real-time noise monitoring results with the attended monitoring results has been completed.

The validation compares monthly attended monitoring results against the closest assessed unattended monitoring location. Currently, TGO has one unattended real time monitoring terminal installed at the Brooklands property (nearest to R23). The **Figure 1** locality plan identifies the location of the monitor with respect to the attended monitoring locations. It is noted that the Brooklands unattended monitor is situated 600m west of the attended noise monitoring location R23, therefore, background (LA90) noise levels are significantly lower due to offset distance to highway traffic.

A comparison of mine noise contributions between attended and unattended noise monitoring demonstrates a general consistency between attended and unattended results. It was noted that wind and insect noise influenced measured noise levels for this assessment period with mine noise remaining below criteria throughout the May 2017 assessment period. Furthermore, for May 2017, results remained below the relevant criteria for both attended and unattended locations.

Table 8 provides a summary comparison of results between the attended and unattended noise surveys for R23.

Table 8 Comparison of Attended and Unattended Results – R23

Assessment Type	Time (hrs)	Descriptor (dBA re 20 µPa) LAmax	LAeq	LA90	Criteria	Mine Noise Contribution	Meteorology[1]	Description and SPL, dBA
Tuesday 2 May 2017								
Attended	21:16	57	48	44	39	39	Dir: SW 4 m/s Stab Class: D	Local residential noise 40-46 Mine hum 36-39 Highway traffic 42-44
Unattended	21:15	55	45	41	39	39		Wind Insects Highway traffic
Attended	22:25	60	45	41	39	39	Dir: S 2 m/s Stab Class: D	Mine hum 36-39 Wind in trees <39 Highway traffic 40-42
Unattended	22:30	57	45	40	39	38		Mine hum Insects Highway traffic
Wednesday 3 May 2017								
Attended	21:13	56	46	38	39	TGO Inaudible	Dir: N 4 m/s Stab Class: D	Birds Highway traffic 46-56 Wind in trees <46
Unattended	21:15	54	42	34	39	TGO Inaudible		Wind Insects Highway traffic
Attended	22:22	60	47	43	39	TGO Inaudible	Dir: N 5 m/s Stab Class: D	Idle trucks 43-46 Wind in trees <43 Highway traffic 43-56
Unattended	22:15	58	42	36	39	TGO Inaudible		Wind Insects Highway traffic
Thursday 4 May2017								
Attended	20:53	59	46	39	39	TGO Inaudible	Dir: N 5 m/s Stab Class: D	Highway traffic 38-54 Wind in trees 38-40-43
Unattended	20:45	60	46	37	39	TGO Inaudible		Wind Insects Highway traffic
Attended	22:23	56	45	42	39	TGO Inaudible	Dir: N 4 m/s Stab Class: D	Highway traffic 46-53 Idle trucks 46-48 Wind
Unattended	22:30	52	40	34	39	TGO Inaudible		Wind Insects Highway traffic

Note 1: Meteorological data obtained from TGO's on-site weather station.

7 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment on behalf of Tomingley Gold Operations (TGO). The assessment was completed to provide monthly monitoring data so that TGO can actively quantify and manage site noise emissions.

Attended monitoring for three consecutive dates, from 2 May 2017 to 4 May 2017, has identified that TGO was audible on several occasions although did not exceed relevant limits on any occasion during the May 2017 assessment period.

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Appendix A - Glossary of Terms

Several technical terms have been used in this report and are explained in **Table A1**.

Table A1 Glossary of Terms

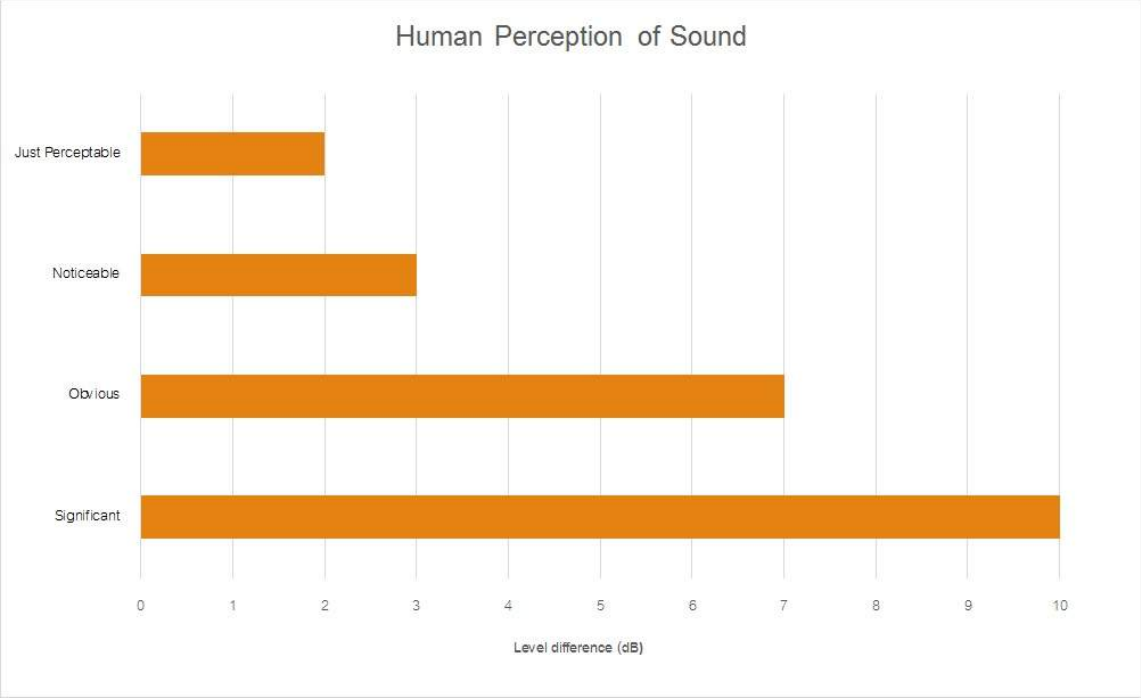
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the INP as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels.
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (SWL)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : = 10.log10 (W/Wo) Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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